PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 12 March 2001 (12.03.01)	
International application No. PCT/NO00/00222	**Applicant's or agent's file reference** P00038
International filing date (day/month/year) 26 June 2000 (26.06.00)	**Priority date** (day/month/year) 25 June 1999 (25.06.99)
Applicant JOHANSEN, Inge et al	

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   17 January 2001 (17.01.01)

   [ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer C. Cupello
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING SUBMISSION OR TRANSMITTAL OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

HOFSETH, Svein
Norsk Hydro ASA
N-0240 Oslo
NORVÈGE

Date of mailing (day/month/year) 03 August 2000 (03.08.00)	
Applicant's or agent's file reference P00038	**IMPORTANT NOTIFICATION**
International application No. PCT/NO00/00222	International filing date (day/month/year) 26 June 2000 (26.06.00)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 25 June 1999 (25.06.99)
Applicant NORSK HYDRO ASA et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).

2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.

3. An **asterisk**(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

4. The **letters "NR"** appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
25 June 1999 (25.06.99)	19993157	NO	11 July 2000 (11.07.00)

The International Bureau of WIPO
34, chemin des Col mbettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer
Marie-José Devillard

Telephone No. (41-22) 338.83.38

WO 01/00353
PCT/NO00/00222

PATENT COOPERATION TREATY

P00038 PCT

From the INTERNATIONAL BUREAU

PCT

To:
HOFSETH, Svein
Norsk Hydro ASA
N-0240 Oslo
NORVÈGE

MOTTATT I N.H.
PATENTAVD.
12 JAN 2001

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

Date of mailing (day/month/year)
04 January 2001 (04.01.01)

Applicant's or agent's file reference
P00038

IMPORTANT NOTICE

International application No.
PCT/NO00/00222

International filing date (day/month/year)
26 June 2000 (26.06.00)

Priority date (day/month/year)
25 June 1999 (25.06.99)

Applicant
NORSK HYDRO ASA et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

   AU,KP,KR,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

   AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CN,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD, GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX, NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on

   04 January 2001 (04.01.01) under No. WO 01/00353

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a **demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer
J. Zahra

Telephone No. (41-22) 338.83.38

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 January 2001 (04.01.2001)

PCT

(10) International Publication Number
WO 01/00353 A1

(51) International Patent Classification[7]: B22D 11/04, 11/124

(21) International Application Number: PCT/NO00/00222

(22) International Filing Date: 26 June 2000 (26.06.2000)

(25) Filing Language: Norwegian

(26) Publication Language: English

(30) Priority Data:
19993157 25 June 1999 (25.06.1999) NO

(71) Applicant *(for all designated States except US)*: **NORSK HYDRO ASA** [NO/NO]; N-0240 Oslo (NO).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **JOHANSEN, Inge** [NO/NO]; Håsenveien 35, N-6600 Sunndalsøra (NO). **MÆLAND, Geir** [NO/NO]; Bruflata 2, N-6600 Sunndalsøra (NO). **STRØMSVÅG, Åge** [NO/NO]; Einangveien 11 E, N-6600 Sunndalsøra (NO).

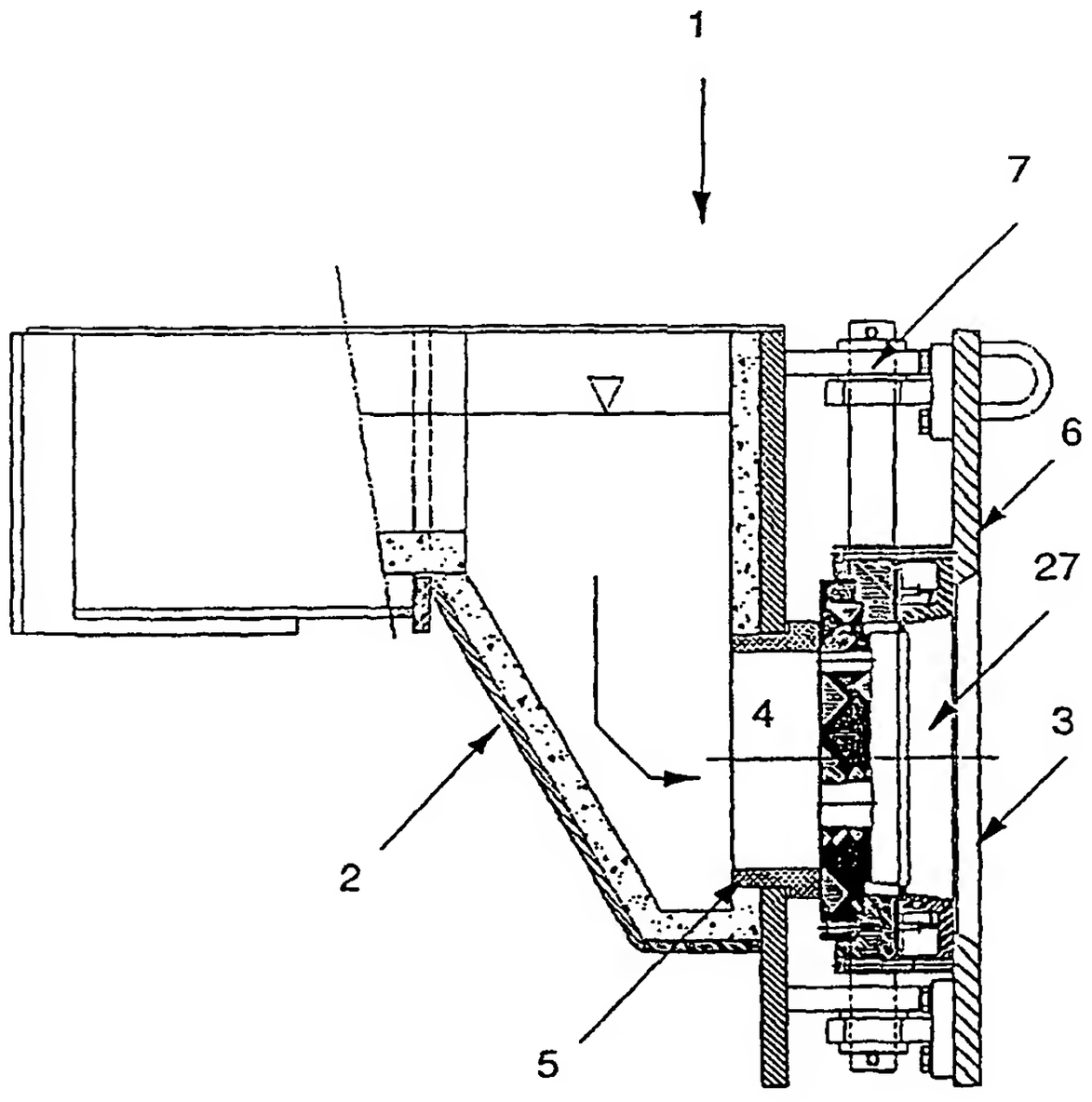
(74) Agent: **HOFSETH, Svein**; Norsk Hydro ASA, N-0240 Oslo (NO).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: EQUIPMENT FOR CONTINUOUS CASTING OF METAL, IN PARTICULAR ALUMINIUM



(57) Abstract: Equipment for continuous, horizontal casting of metal, in particular aluminium, the equipment including an insulated reservoir or pool (2), which is designed to contain liquid metal, and a releasably attached mould (3), which can be removed from the pool (2), with an insulating plate (19) with holes (25, 26) which communicate with the mould, the mould (3) including a preferably circular mould cavity (17) with a wall (12, 13) of permeable material for the supply of oil and gas. The wall provides primary cooling to the metal being cast and at least one slit or nozzles (16) arranged along the circumference of the cavity for the direct supply of coolant, providing secondary cooling at the metal. The primary cooling is so designed that it may be increased or reduced. That the insulating plate (19) is replaceable and, depending on the type of alloy and the cooling required, is designed to extend along the permeable material (12, 13) (at 24) in the cavity (17).

WO 01/00353 A1

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Equipment for continuous casting of metal, in particular aluminium

The present invention concerns equipment for continuous, horizontal casting of metal, in particular aluminium, including an insulated reservoir or pool, which is designed to contain liquid metal, and a mould, which can be removed from the pool, with an insulating plate with holes which communicate with the mould. The mould includes a preferably circular mould cavity with a wall of permeable material, for example graphite, for the supply of oil and/or gas which wall provides primary cooling to the metal being cast, and at least one slit or nozzles arranged along the circumference of the cavity for the direct supply of coolant, providing secondary cooling to the metal.

As stated above, directly cooled horizontal casting equipment for continuous casting of metal in which oil and/or gas is supplied through the mould cavity wall through an annulus or a permeable wall element in order to form a lubricant film between the mould wall and the metal is already known.

Although this type of casting equipment functions reasonably well, the quality of the cast product is, however, much poorer than that of equivalent vertical casting equipment in which, in addition to oil, gas is also supplied through the cavity wall.

One of the disadvantages of vertical casting equipment is that it comprises a large number of moulds. This makes it expensive to produce.

Moreover, the vertical equipment is only designed to cast specific lengths in a semi-continuous process. This also makes it expensive to operate.

Casting with horizontal casting equipment involves the use of only a few moulds and the casting takes place continuously. Suitable lengths of the cast product are cut off during the casting operation. The continuous, horizontal casting equipment is thus both cheap to produce and cheap to operate.

One aim of the present invention was to produce horizontal equipment for continuous casting of metal, in particular aluminium, with which the quality of the cast product is as good as the quality of the equivalent cast product with vertical casting equipment. Further, an object with the present invention has been to provide equipment that is flexible with regard to casting different types of alloys.

The equipment in accordance with the present invention is characterised in that the primary cooling is designed to enable increased or reduced cooling of the metal being cast.

Dependent claims 2-5 define the advantageous features of the present invention.

The present invention will be described in the following in further detail using examples and with reference to the attached drawings, where:

Fig. 1 shows, in part, in an elevation, the casting equipment for continuous horizontal casting of long objects, for example aluminium tie rods.

Fig. 2 shows, in large scale, the mould shown in Fig. 1, a) in cross-section and b) in a longitudinal section.

As Fig. 1 shows, the casting equipment 1 in accordance with the present invention comprises an insulated metal reservoir or pool 2 and a mould 3. The pool 2 is provided with a lateral opening 4 to the mould 3, where a connecting ring 5 of thermally insulating material forms the transition between the pool and the mould 3. On its side, the mould is releasably attached to a holding device 6. Via a hinge link 7, it is possible to swing the holding device and thus the mould 3 from a position in which it is in contact with the connecting ring 5 to a swung-out position which makes it possible to remove (replace) or repair the mould.

The mould itself, which is shown in further detail in Fig. 2, comprises a two-part annular housing, of which a first main housing part 8 is provided with drilled holes 10,11 for the supply of oil or gas to interior, permeable cavity rings 12,13, while a second housing part 9 is provided with an annular recess which forms a water cooling channel 14. The two housing parts 8 and 9 are held together by means of a

number of screws 15. When they are screwed together, as shown in the figure, a diagonal slit or gap 16 is formed between the two parts so that, during the casting operation, water flows from the channel 14 and through the gap 16 along the entire periphery of the cast product just outside the outlet of the cavity 17. Hereby a primary cooling circle (primary cooling of the metal being cast) is formed by transport of heat through the wall (13,14) and to the water in the channel 14, and a secondary cooling circle by the water being ejected directly on the metal through the slit 16.

As mentioned, permeable rings 12, 13, which are physically separated from each other by a gasket, sealing material 18 or similar, are included. These rings form the wall in the cavity 17.

An important feature of the present invention is that the annuli 20 (see Fig. 2, b)) formed between the mould housing 8 and the rings 12,13 are provided with plugs 21 or similar (only 2 shown in the drawing) so that the annuli 20 are broken up into two or more restrictions sectors as required. In this way, the supply of both gas and oil can be differentiated along the circumference of the cavity. Such differentiation, in particular of the gas supply, is important in order to be able to achieve a good casting result.

Supply of gas to horizontal casting equipment is previously not known. To avoid inclusion of excess gas in the metal under the casting operation a bore 29 is preferably provided in the upper part of the mould cavity. The bore stretches through the ring 12 to an annulus outside the ring to another bore (now shown) leading to the atmosphere.

At the inlet of the cavity 17, there is a plate 19 of thermally insulating material ("hot-top") which is held in place using a retaining ring 22 via a screw connection 23.

As the wall of the cavity 17, i.e. the rings 12, 13, forms the primary cooling area during the casting operation, the area of the wall surface will represent one of the factors which determine the cooling of the metal.

The insulating plate 19 may, depending on the type of alloy and the primary cooling required, extend along the ring 12 (at 24) somewhat.

As the plate can be easily detached, it will be easy to replace the plate and thus cast different types of alloy in the same mould.

Otherwise, the casting equipment in accordance with the present invention works as follows:
Liquid metal, for example aluminium, is poured into the pool 2 from a casting furnace or similar (not shown). The metal flows through the opening 4 and the holes 25, 26 in the plate 19 into the cavity 17.

At the beginning of the casting operation, the outlet 27 in the mould 3 is closed using a mobile casting shoe (not shown). As soon as the metal has filled the cavity 17, the shoe begins to move, while water is supplied through the gap 16 and gas and oil are supplied through the ring 12, 13.

As the casting shoe moves and the cavity is refilled with metal via the pool, a long casting piece is formed. The shoe is removed as soon as the casting piece has reached a certain length. Since the casting process is continuous, the casting piece may actually be of any length. However, it is expedient for the casting piece to be cut (not shown) into suitable lengths for extrusion or other purposes.

As mentioned above, the casting equipment is designed for differentiated supply of oil and gas around the circumference.

In particular regarding the supply of gas, it has been found expedient to supply the same quantity of gas around the entire circumference of the cavity at the start of the casting process. Subsequently, when the casting process has started and has become stable, the gas supply to the upper area of the cavity is reduced or omitted.

Moreover, regarding the primary cooling, i.e. the cooling through the rings 12, 13 in the cavity 17, it has been found expedient, in order to reduce the cooling, to make the mould housing 8, of steel instead of aluminium, which is the usual material. Furthermore, in order to reduce the cooling further, it may be necessary to shield (reduce the thermal transfer to) the cooling channel 14 by arranging an insulating annular plate 28, for example of Plexiglas, on the side of the housing part which

faces the cooling channel. This may preferably be exchangeable and be of different thickness.

The invention as defined in the claims is not restricted to the embodiments shown in the drawings and described above. Thus, instead of two rings (12,13) forming the wall of the mould cavity, only one ring may be employed whereby the oil and gas may be supplied through this one and only ring.

Claims

1. Equipment for continuous, horizontal casting of metal, in particular aluminium, the equipment including an insulated reservoir or pool (2), which is designed to contain liquid metal, and a releasably provided mould (3), which can be removed from the pool (2), with an insulating plate (19) with holes (25, 26) which communicate with the mould, the mould (3) including a preferably circular mould cavity (17) with a wall (12, 13) of permeable material for the supply of oil and/or gas, which wall provides primary cooling to the metal being cast and at least one slit or nozzles (16) arranged along the circumference of the cavity for the direct supply of coolant, providing secondary cooling at the metal,
c h a r a c t e r i s e d i n that the primary cooling is so designed that it may be increased or reduced.

2. Equipment according to claim 1,
c h a r a c t e r i s e d i n that the insulating plate (19) is easily replaceable whereby it is provided with a protrusion (24) extending along the wall (12,13) of the cavity (17) and whereby the surface of and subsequently the cooling effect may be reduced or increased depending on the length of the protrusion (24).

3. Equipment according to claims 1 and 2,
c h a r a c t e r i s e d i n that the mould housing (8) is made of steel.

4. Equipment according to claims 1-3,
c h a r a c t e r i s e d i n that the mould housing includes two parts (8, 9) with an intermediate cooling channel (14) where a thermally insulating annular plate (28) is arranged against the first part (8) which surrounds the permeable material (12, 13) in the cavity (17) in order to reduce the thermal transfer to the cavity.

5. Equipment according to claim 4,
c h a r a c t e r i s e d i n that the insulating plate (28) is exchangeable and may have different thickness.

Fig. 1

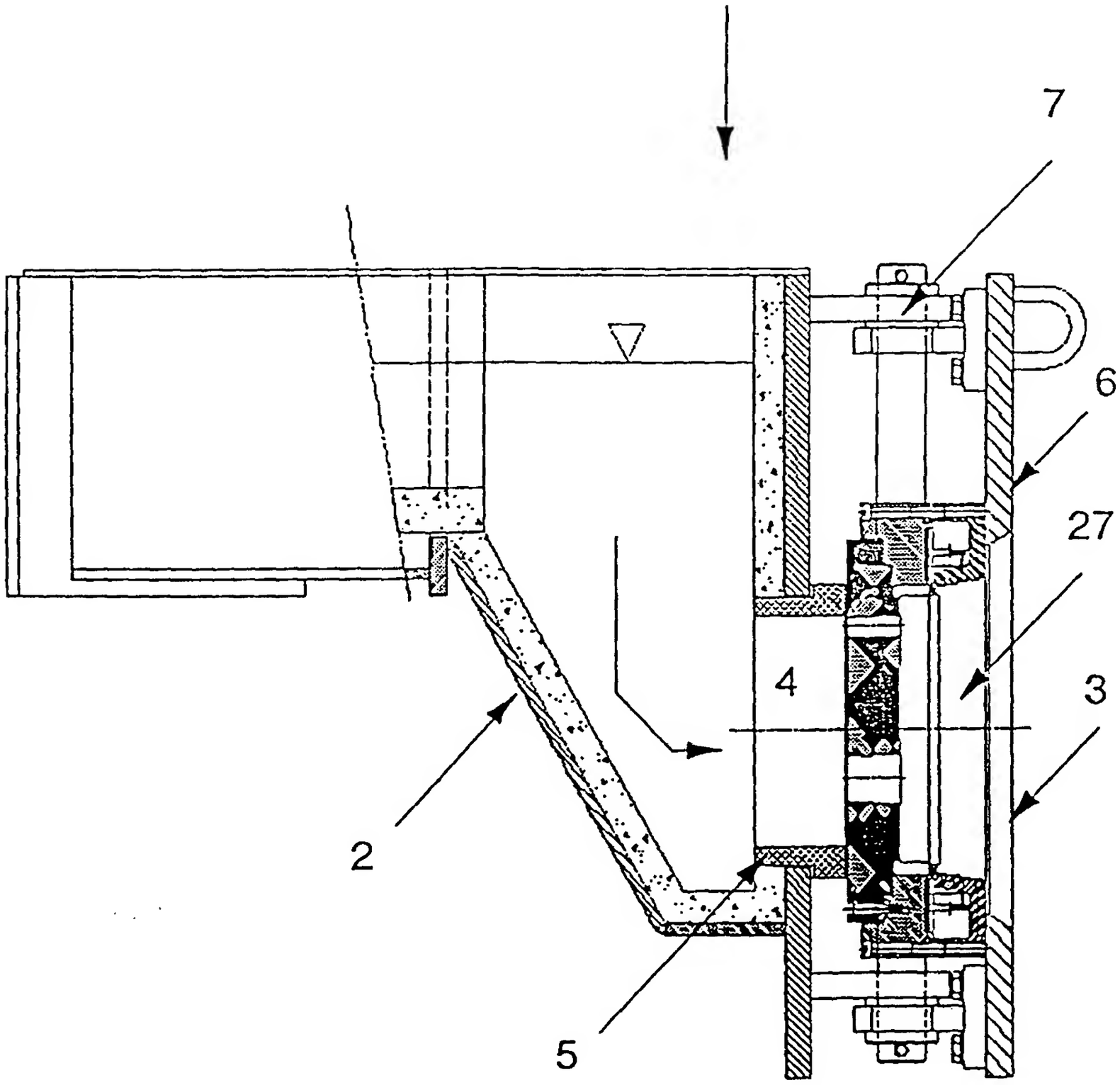
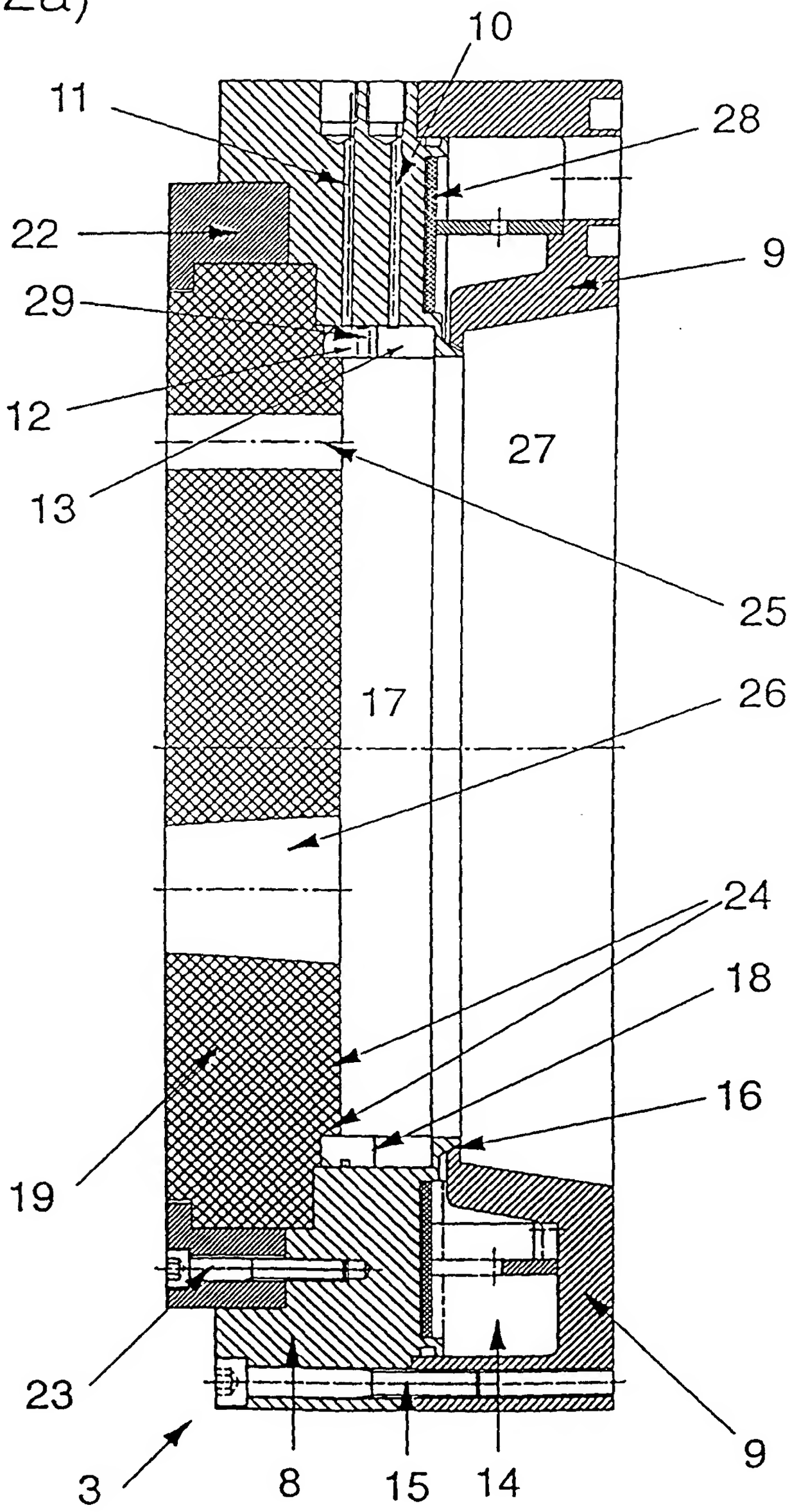
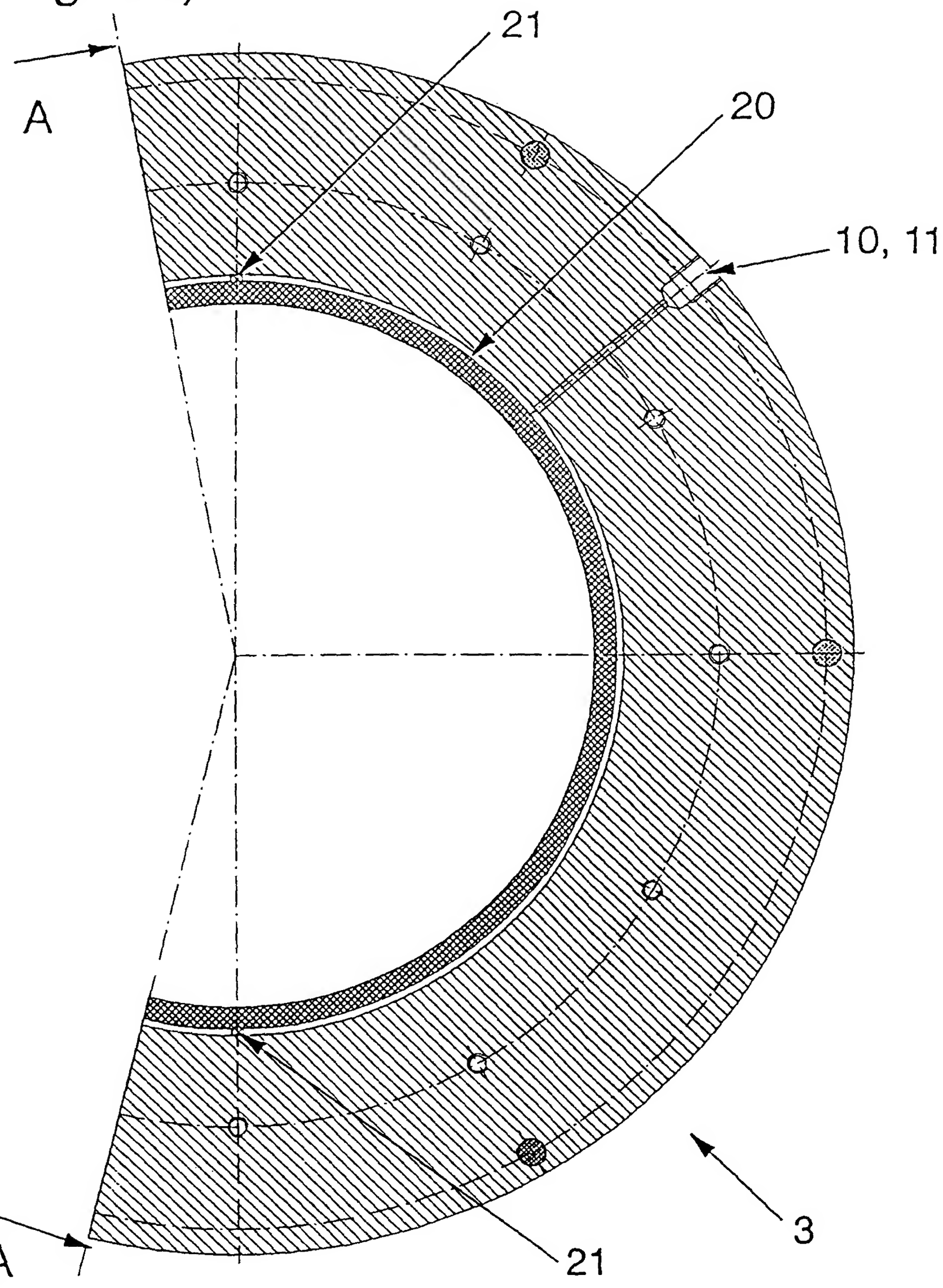


Fig. 2a)



Section A-A

Fig. 2b)



INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 00/00222

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B22D 11/04, B22D 11/124
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B22D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	NO 302804 B (NORSK HYDRO ASA), 27 April 1998 (27.04.98), page 3, line 14 - page 5, line 12, figure 2, abstract --	1-5
Y	DE 932085 C (COMPAGNIE GENERALE DU DURALUMIN & DU CUIVRE), 22 August 1955 (22.08.55), figure 1, claims 1,2 --	1-5
Y	US 4523624 A (J.A. DANTZIG ET AL), 18 June 1985 (18.06.85), column 4, line 11 - line 30, figure 1 --	1-5

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 Sept 2000	02 -10- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ulf Nyström / MRo Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 00/00222

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4688624 A (K. SUZUKI ET AL), 25 August 1987 (25.08.87), column 6, line 1 - column 7, line 7, figures 4-6	1-5

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INTERNATIONAL SEARCH REPORT

Information on patent family members

01/08/00

International application No.
PCT/NO 00/00222

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
NO 302804 B	27/04/98	AU 694676 B	23/07/98
		AU 6217596 A	13/03/97
		CA 2184668 A	09/03/97
		CN 1157763 A	27/08/97
		FR 2738509 A,B	14/03/97
		IL 119098 D	00/00/00
		NO 953545 A	10/03/97
		RU 2141883 C	27/11/99
		US 5915455 A	29/06/99
DE 932085 C	22/08/55	NONE	
US 4523624 A	18/06/85	AT 18144 T	15/03/86
		AU 8944182 A	28/04/83
		BR 8206146 A	20/09/83
		DE 3269433 D	00/00/00
		EP 0077950 A,B	04/05/83
		SE 0077950 T3	
		ES 516708 A	16/03/84
		ES 8403344 A	16/06/84
		JP 58081546 A	16/05/83
US 4688624 A	25/08/87	AU 560021 B	26/03/87
		AU 3388084 A	20/03/86
		DE 3526689 A,C	06/02/86
		FR 2568153 A,B	31/01/86
		GB 2163685 A,B	05/03/86
		JP 1907391 C	24/02/95
		JP 6035030 B	11/05/94
		JP 61033735 A	17/02/86
		NZ 209807 A	12/11/86
		US 4653571 A	31/03/87
		JP 1795418 C	28/10/93
		JP 5004170 B	19/01/93
		JP 61071157 A	12/04/86

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference P00038	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/NO 00/00222	International filing date *(day/month/year)* 26 June 2000	(Earliest) Priority Date *(day/month/year)* 25 June 1999
Applicant Norsk Hydro ASA et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] **Certain claims were found unsearchable** (See Box I).

2. [ ] ***Unity of invention* is lacking** (See Box II).

3. [ ] The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing
   - [ ] filed with the international application.
   - [ ] furnished by the applicant separately from the international application,
     - [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
   - [ ] transcribed by this Authority.

4. With regard to the **title**,
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is:
   Figure No. 1
   - [X] as suggested by the applicant.
   - [ ] because the applicant failed to suggest a figure.
   - [ ] because this figure better characterizes the invention.
   - [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 00/00222

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B22D 11/04, B22D 11/124
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B22D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	NO 302804 B (NORSK HYDRO ASA), 27 April 1998 (27.04.98), page 3, line 14 - page 5, line 12, figure 2, abstract --	1-5
Y	DE 932085 C (COMPAGNIE GENERALE DU DURALUMIN & DU CUIVRE), 22 August 1955 (22.08.55), figure 1, claims 1,2 --	1-5
Y	US 4523624 A (J.A. DANTZIG ET AL), 18 June 1985 (18.06.85), column 4, line 11 - line 30, figure 1 --	1-5

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 Sept 2000	02 -10- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ulf Nyström / MRo Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 00/00222

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4688624 A (K. SUZUKI ET AL), 25 August 1987 (25.08.87), column 6, line 1 - column 7, line 7, figures 4-6 -- --------	1-5

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/08/00

International application No.
PCT/NO 00/00222

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
NO 302804 B	27/04/98	AU 694676 B	23/07/98
		AU 6217596 A	13/03/97
		CA 2184668 A	09/03/97
		CN 1157763 A	27/08/97
		FR 2738509 A,B	14/03/97
		IL 119098 D	00/00/00
		NO 953545 A	10/03/97
		RU 2141883 C	27/11/99
		US 5915455 A	29/06/99
DE 932085 C	22/08/55	NONE	
US 4523624 A	18/06/85	AT 18144 T	15/03/86
		AU 8944182 A	28/04/83
		BR 8206146 A	20/09/83
		DE 3269433 D	00/00/00
		EP 0077950 A,B	04/05/83
		SE 0077950 T3	
		ES 516708 A	16/03/84
		ES 8403344 A	16/06/84
		JP 58081546 A	16/05/83
US 4688624 A	25/08/87	AU 560021 B	26/03/87
		AU 3388084 A	20/03/86
		DE 3526689 A,C	06/02/86
		FR 2568153 A,B	31/01/86
		GB 2163685 A,B	05/03/86
		JP 1907391 C	24/02/95
		JP 6035030 B	11/05/94
		JP 61033735 A	17/02/86
		NZ 209807 A	12/11/86
		US 4653571 A	31/03/87
		JP 1795418 C	28/10/93
		JP 5004170 B	19/01/93
		JP 61071157 A	12/04/86

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P00038	**FOR FURTHER ACTION**	*See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)*
International application No. PCT/NO00/00222	International filing date *(day/month/year)* 26/06/2000	Priority date *(day/month/year)* 25/06/1999
International Patent Classification (IPC) or national classification and IPC B22D11/04		
Applicant		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (*see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT*).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ *Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement*
   - VI ☐ *Certain documents cited*
   - VII ☒ *Certain defects in the international application*
   - VIII ☒ Certain observations on the international application

Date of submission of the demand 17/01/2001	Date of completion of this report 16.07.2001
Name and mailing address of the international *preliminary examining authority:* European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Fiala, F Telephone No. +49 89 2399 2925

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NO00/00222

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-5 as originally filed

Claims, No.:

1-5 as originally filed

Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application.

   ☒ claims Nos. 1-5.

because:

   ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

   ☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 1-5 are so unclear that no meaningful opinion could be formed (*specify*):
   see separate sheet

   ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

   ☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the standard.

   ☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

   Novelty (N) Yes: Claims -

	No:	Claims -
Inventive step (IS)	Yes:	Claims -
	No:	Claims -
Industrial applicability (IA)	Yes:	Claims -
	No:	Claims -

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

1). Claim 1 is not allowable because the term "the primary cooling is so designed" is unclear. Primary cooling is an action applied to the metal and it is unclear how such an action can be "designed".
Furthermore, the characterising portion states only that a desired result should be obtained, i.e. an increased or reduced cooling without giving the structural features necessary to obtain this effect.
It appears from the first portion of the claim that primary cooling is provided by the wall (12,13), (see also page 3, second para. from the bottom); however no special wall features are defined in the characterising portion for its design to obtain increased or reduced cooling.

2). The examination with regard to novelty and inventive step is not possible because claim 1 has not been clarified.

3). Claim 3 has no antecedent for "the" mould housing.
Claim 4 refers to claim 1 which is silent about a mould housing.

PATENT COOPERATION TREATY

PCT

REC'D 18 JUL 2001
WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference P00038	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/NO00/00222	International filing date *(day/month/year)* 26/06/2000	Priority date *(day/month/year)* 25/06/1999
International Patent Classification (IPC) or national classification and IPC B22D11/04		
Applicant		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

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3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
17/01/2001	16.07.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Fiala, F Telephone No. +49 89 2399 2925

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NO00/00222

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-5 as originally filed

Claims, No.:

1-5 as originally filed

Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 1-5.

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 1-5 are so unclear that no meaningful opinion could be formed (*specify*):
see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N) Yes: Claims -

	No:	Claims	-
Inventive step (IS)	Yes:	Claims	-
	No:	Claims	-
Industrial applicability (IA)	Yes:	Claims	-
	No:	Claims	-

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

1). Claim 1 is not allowable because the term "the primary cooling is so designed" is unclear. Primary cooling is an action applied to the metal and it is unclear how such an action can be "designed".
Furthermore, the characterising portion states only that a desired result should be obtained, i.e. an increased or reduced cooling without giving the structural features necessary to obtain this effect.
It appears from the first portion of the claim that primary cooling is provided by the wall (12,13), (see also page 3, second para. from the bottom); however no special wall features are defined in the characterising portion for its design to obtain increased or reduced cooling.

2). The examination with regard to novelty and inventive step is not possible because claim 1 has not been clarified.

3). Claim 3 has no antecedent for "the" mould housing.
Claim 4 refers to claim 1 which is silent about a mould housing.

1815 PCT/IN00/00222

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2000 -06- 26

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

PCT/NO 0 0 / 0 0 2 2 2
International Application No.

26 JUNI 2000 (26.06.2000)
International Filing Date

PATENTSTYRET
Styret for det industrielle rettsvern
PCT International application
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum) P00038

Box No. I TITLE OF INVENTION
ARRANGEMENT FOR EQUIPMENT RELATED TO HORIZONTAL, CONTINUOUS CASTING OF METAL

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

NORSK HYDRO ASA
N-0240 OSLO
NORWAY

☐ This person is also inventor.

Telephone No.
47-22-432100

Facsimile No.
47-22-432308

Teleprinter No.

State *(that is, country)* of nationality:
NO

State *(that is, country)* of residence:
NO

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

JOHANSEN, Inge
Håsenveien 35
N-6600 Sunndalsøra
Norway

This person is:
☐ applicant only
☒ applicant and inventor
☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:
NO

State *(that is, country)* of residence:
NO

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

HOFSETH, Svein
Norsk Hydro ASA
N-0240 Oslo
Norway

Telephone No.
47-22-432903

Facsimile No.
47-22-432308

Teleprinter No.

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

MÆLAND, Geir
Bruflata 2
N-6600 Sunndalsøra
Norway

This person is:
☐ applicant only
☒ applicant and inventor
☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: NO

State *(that is, country)* of residence: NO

This person is applicant for the purposes of:
☐ all designated States
☐ all designated States except the United States of America
☒ the United States of America only
☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

STRØMSVÅG, Åge
Einangveien 11 E
N-6600 Sunndalsøra
Norway

This person is:
☐ applicant only
☒ applicant and inventor
☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: NO

State *(that is, country)* of residence: NO

This person is applicant for the purposes of:
☐ all designated States
☐ all designated States except the United States of America
☒ the United States of America only
☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
☐ applicant only
☐ applicant and inventor
☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
☐ all designated States
☐ all designated States except the United States of America
☐ the United States of America only
☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
☐ applicant only
☐ applicant and inventor
☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
☐ all designated States
☐ all designated States except the United States of America
☐ the United States of America only
☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

☒ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **SD** Sudan, **SL** Sierra Leone, **SZ** Swaziland, **TZ** United Republic of Tanzania, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

☒ **EA** **Eurasian Patent:** **AM** Armenia, **AZ** Azerbaijan, **BY** Belarus, **KG** Kyrgyzstan, **KZ** Kazakhstan, **MD** Republic of Moldova, **RU** Russian Federation, **TJ** Tajikistan, **TM** Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

☒ **EP** **European Patent:** **AT** Austria, **BE** Belgium, **CH and LI** Switzerland and Liechtenstein, **CY** Cyprus, **DE** Germany, **DK** Denmark, **ES** Spain, **FI** Finland, **FR** France, **GB** United Kingdom, **GR** Greece, **IE** Ireland, **IT** Italy, **LU** Luxembourg, **MC** Monaco, **NL** Netherlands, **PT** Portugal, **SE** Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

☒ **OA** **OAPI Patent:** **BF** Burkina Faso, **BJ** Benin, **CF** Central African Republic, **CG** Congo, **CI** Côte d'Ivoire, **CM** Cameroon, **GA** Gabon, **GN** Guinea, **GW** Guinea-Bissau, **ML** Mali, **MR** Mauritania, **NE** Niger, **SN** Senegal, **TD** Chad, **TG** Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* . . . . . .

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

☒ **AE** United Arab Emirates
☒ **AL** Albania . . . . . .
☒ **AM** Armenia . . . . . .
☒ **AT** Austria . . . . . .
☒ **AU** Australia . . . . . .
☒ **AZ** Azerbaijan
☒ **BA** Bosnia and Herzegovina . . . . . .
☒ **BB** Barbados
☒ **BG** Bulgaria . . . . . .
☒ **BR** Brazil . . . . . .
☒ **BY** Belarus . . . . . .
☒ **CA** Canada
☒ **CH and LI** Switzerland and Liechtenstein
☒ **CN** China . . . . . .
☒ **CR** Costa Rica . . . . . .
☒ **CU** Cuba . . . . . .
☒ **CZ** Czech Republic . . . . . .
☒ **DE** Germany . . . . . .
☒ **DK** Denmark . . . . . .
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☒ **EE** Estonia . . . . . .
☒ **ES** Spain . . . . . .
☒ **FI** Finland . . . . . .
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☒ **GD** Grenada
☒ **GE** Georgia . . . . . .
☒ **GH** Ghana . . . . . .
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☒ **IL** Israel . . . . . .
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☒ **KE** Kenya . . . . . .
☒ **KG** Kyrgyzstan . . . . . .
☒ **KP** Democratic People's Republic of Korea . . . . . .
☒ **KR** Republic of Korea . . . . . .
☒ **KZ** Kazakhstan . . . . . .
☒ **LC** Saint Lucia
☒ **LK** Sri Lanka
☒ **LR** Liberia
☒ **LS** Lesotho . . . . . .
☒ **LT** Lithuania
☒ **LU** Luxembourg
☒ **LV** Latvia
☒ **MA** Morocco . . . . . .
☒ **MD** Republic of Moldova . . . . . .
☒ **MG** Madagascar . . . . . .
☒ **MK** The former Yugoslav Republic of Macedonia . . . . . .
☒ **MN** Mongolia
☒ **MW** Malawi . . . . . .
☒ **MX** Mexico . . . . . .
☒ **NO** Norway
☒ **NZ** New Zealand . . . . . .
☒ **PL** Poland . . . . . .
☒ **PT** Portugal . . . . . .
☒ **RO** Romania
☒ **RU** Russian Federation . . . . . .
☒ **SD** Sudan
☒ **SE** Sweden
☒ **SG** Singapore
☒ **SI** Slovenia . . . . . .
☒ **SK** Slovakia . . . . . .
☒ **SL** Sierra Leone . . . . . .
☒ **TJ** Tajikistan . . . . . .
☒ **TM** Turkmenistan . . . . . .
☒ **TR** Turkey . . . . . .
☒ **TT** Trinidad and Tobago . . . . . .
☒ **TZ** United Republic of Tanzania
☒ **UA** Ukraine . . . . . .
☒ **UG** Uganda . . . . . .
☒ **US** United States of America . . . . . .
☒ **UZ** Uzbekistan . . . . . .
☒ **VN** Viet Nam . . . . . .
☒ **YU** Yugoslavia . . . . . .
☒ **ZA** South Africa . . . . . .
☒ **ZW** Zimbabwe . . . . . .

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ . . . . . .
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Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn bythe applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*

PCT/NO 00/ 00222

Sheet No. 4

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application *(day/month/year)*	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 25 June 1999 (25.06.99)	19993157	Norway		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): 19993157

** Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)* :

ISA / SE

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority)*:

Date *(day/month/year)* Number Country *(or regional Office)*

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets**:

request	:	4
description (excluding sequence listing part)	:	5
claims	:	2
abstract	:	1
drawings	:	3
sequence listing part of description	:	
Total number of sheets	:	15

This international application is **accompanied by** the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: Search Report

Figure of the drawings which should accompany the abstract: 1

Language of filing of the international application: Norwegian

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity isnot obvious from reading the request).

Svein Hofseth

For receiving Office use only

1. Date of actual receipt of the purported international application: 26 JUNI 2000 (26.06.2000)
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority (if two or more are competent): ISA /SE
6. ☐ Transmittal of search copy delayed until search fee is paid.

2. Drawings:
☒ received:
☐ not received:

For International Bureau use only

Date of receipt of the record copy by the International Bureau: 11 JULY 2000 (11.07.00)

Fig. 1

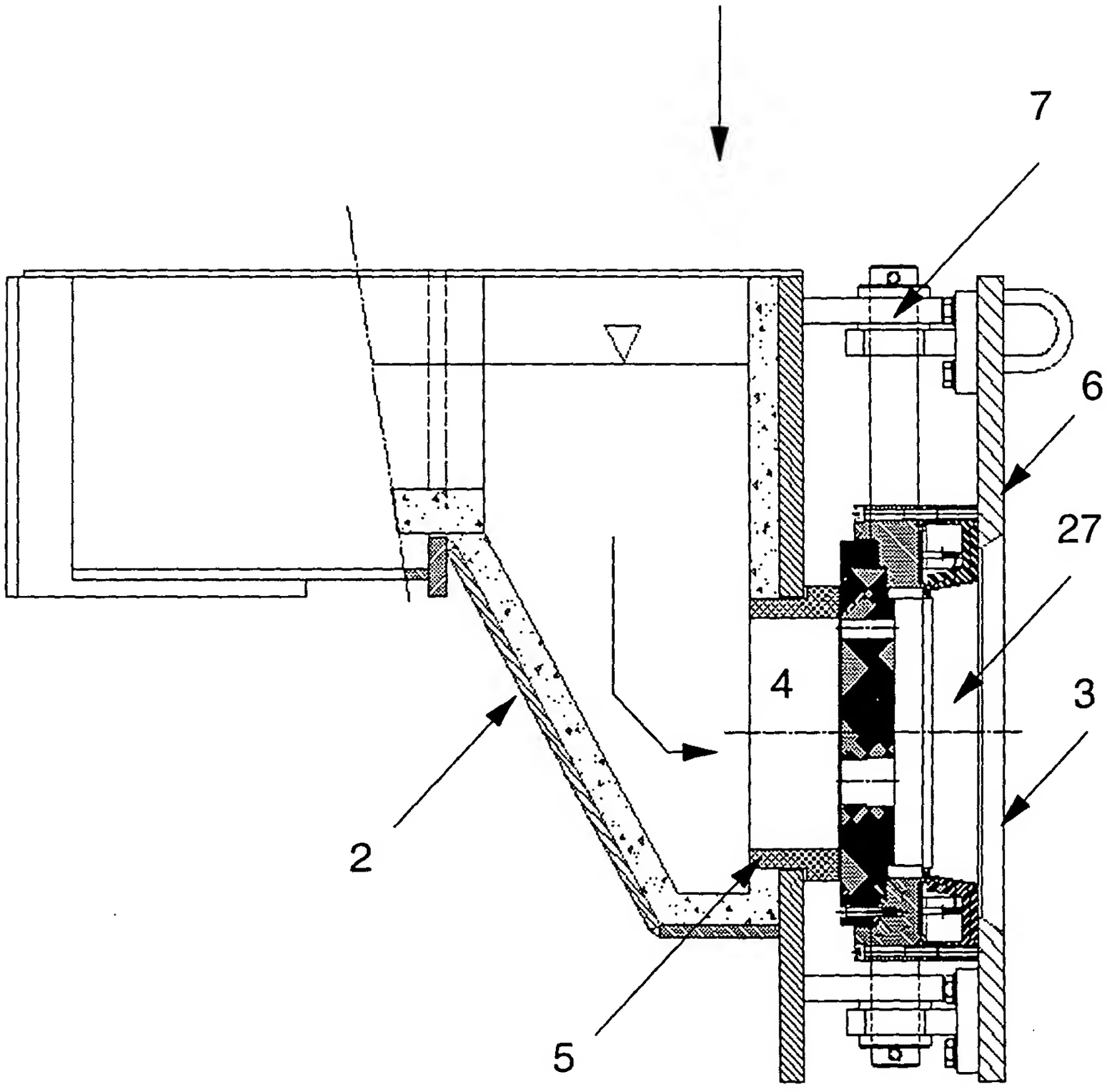
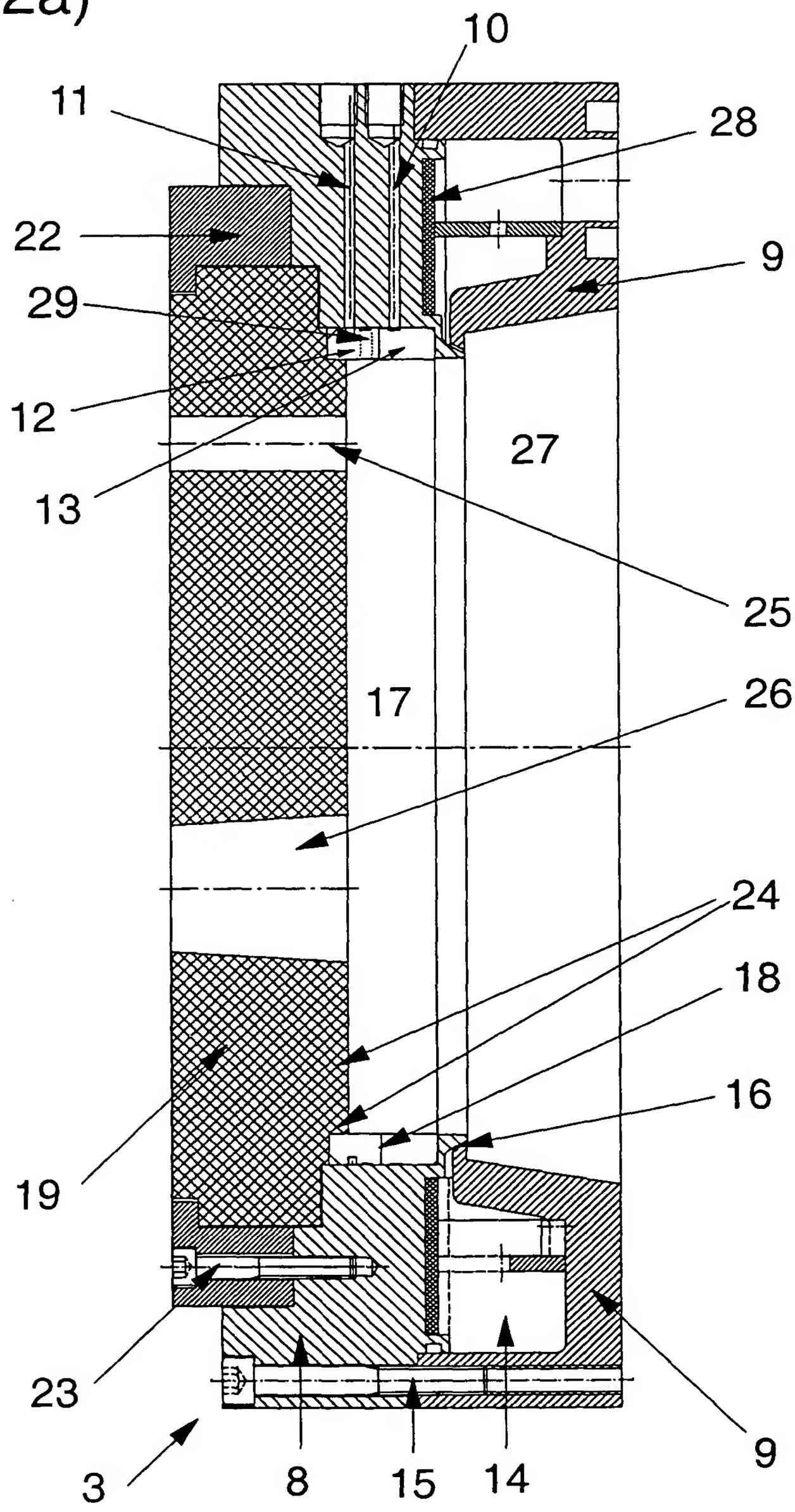
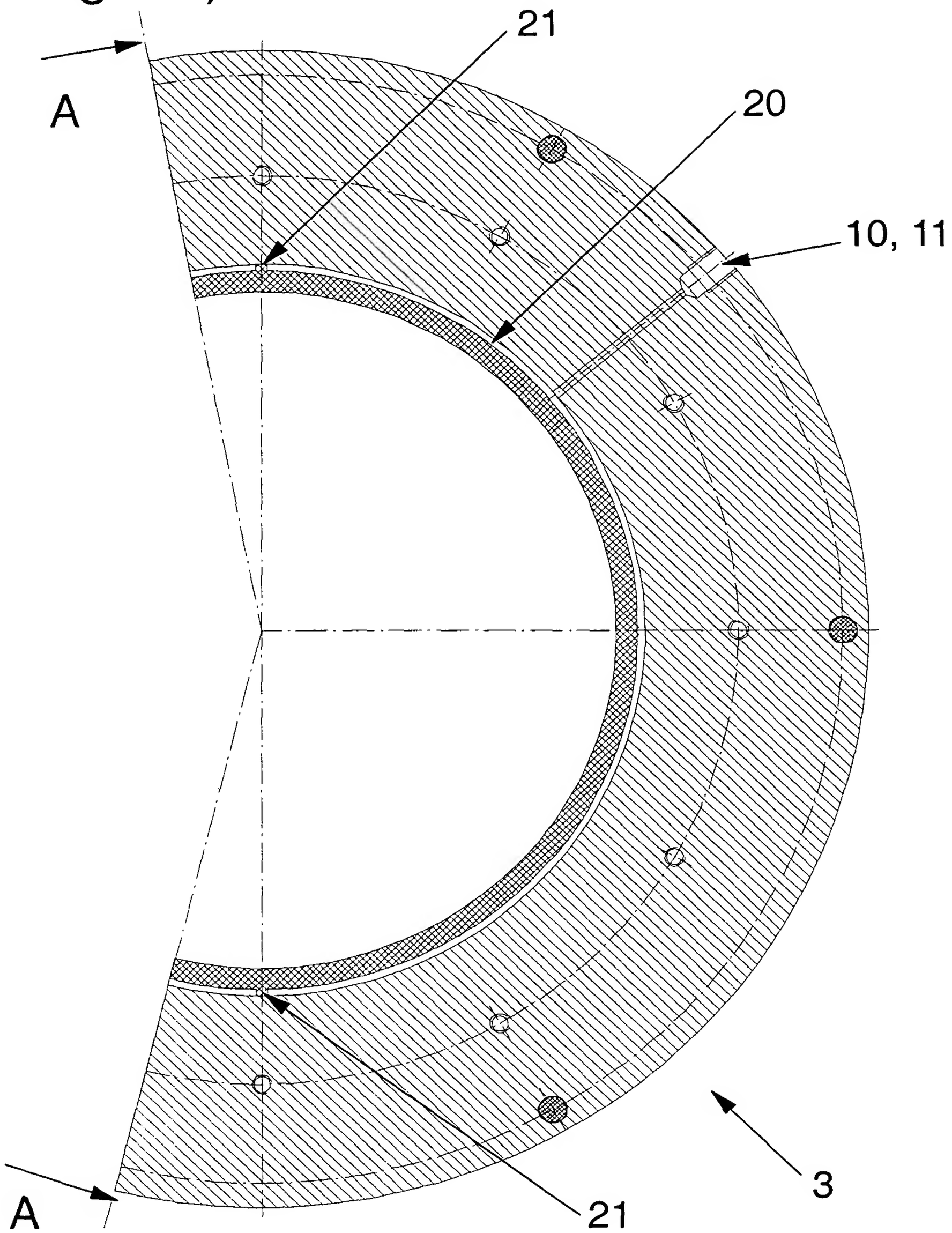


Fig. 2a)



Snitt A - A

Fig. 2b)



Anordning ved utstyr for kontinuerlig støping av metall, spesielt aluminium

Foreliggende oppfinnelse vedrører en anordning ved utstyr for kontinuerlig, horisontal støping av metall, spesielt aluminium, innbefattende et isolert reservoar eller kulp som er innrettet til å romme flytende metall, samt en i forhold til kulpen løstagbart anordnet støpeform med en isolerende plate med hull som kommuniserer med støpeformen, hvilken støpeform innbefatter et fortrinnsvis sirkulært formrom med en vegg av permeabelt materiale, f.eks. grafitt, for tilførsel av olje og/eller gass, hvilken vegg er innrettet for primærkjøling av metallet som skal støpes, samt minst en langs omkretsen av formrommet anordnet ringdyse for direkte tilførsel av kjølemedie ved sekundærkjøling av metallet.

Som angitt ovenfor, er det altså tidligere kjent direkte kjølt horisontalt støpeutstyr for kontinuerlig støping av metall der olje tilføres gjennom formromveggen gjennom en ringspalte eller et permeabelt veggelement og har som oppgave å danne en smørende film mellom formveggen og metallet.

Selv om denne type støpeutstyr fungerer rimelig bra er kvaliteten til det støpte produkt likevel vesentlig dårligere enn for tilsvarende vertikalt støpeutstyr der det i tillegg til olje også tilføres gass gjennom formromveggen.

Ulempen med vertikalt støpeutstyr er bl.a at det omfatter et stort antall støpeformer som gjør at det er kostbart å fremstille.

Dernest er det vertikale utstyret kun innrettet til å støpe bestemte lengder i en semikontinuerlig prosess som gjør at det også er dyrt å operere.

Ved støping med horisontalt støpeutstyr benyttes kun et par støpeformer, og støpingen foregår kontinuerlig, idet passende lengder av det støpte produkt kuttes av under støpeoperasjonen. Det kontinuerlige, horisontale støpeutstyret er således både rimelig å fremstille og rimelig å operere.

Det har vært et formål med foreliggende oppfinnelse å fremskaffe horisontalt utstyr for kontinuerlig støping av metall, spesielt aluminium, hvor kvaliteten på det støpte produkt har minst like god kvalitet som tilsvarende produkt støpt med vertikalt støpeutstyr. Det har videre vært et formål å fremskaffe utstyr som er fleksibelt med hensyn til å støpe forskjellige typer legeringer.

Utstyret i henhold til oppfinnelsen er karakterisert ved at primærkjølingen er innrettet slik at den kan reduseres eller økes.

Kravene 2-5 angir fordelaktige trekk ved oppfinnelsen.

Oppfinnelsen skal beskrives nærmere i det etterfølgende ved hjelp av eksempel og med henvisning til vedføyde tegninger hvor:

Fig. 1 viser, delvis, i oppriss støpeutstyr for kontinuerlig horisontalstøping av langstrakte gjenstander, f.eks. aluminium pressbolt,

Fig. 2 viser i større målestokk selve støpeformen vist i Fig. 1, h.h.v. a) i tverrsnitt og b) i lengdesnitt.

Som det fremgår av Fig. 1 omfatter støpeutstyret 1 i h.h.t. oppfinnelsen et isolert metallforråd eller kulp 2 og en støpeform 3. Kulpen 2 er forsynt med en sideveis anordnet åpning 4 mot støpeformen 3, hvor en forbindelsesring 5 av varmeisolerende materiale danner overgangen mellom kulpen og støpeformen 3.
Støpeformen på sin side er løstagbart festet til en holdeinnretning 6 som via en hengselforbindelse 7 gjør det mulig å svinge holdeinnretningen og dermed støpeformen 3 fra en posisjon hvor den ligger til anlegg mot forbindelsesringen 5 til en utsvinget posisjon som gjør det mulig å demontere (utskifte) eller reparere støpeformen.

Selve støpeformen som er nærmere vist i Fig. 2, innbefatter et to-delt ringformet hus, hvorav en første 8 hovedhusdel er forsynt med boringer 10,11 for tilførsel av olje, respektive gass til innenfor liggende, permeable formromringer 12,13, mens en andre husdel 9 er forsynt med en ringformet utsparing som danner en vannkjølekanal 14. De to husdelene 8 og 9 fastholdes til hverandre ved hjelp av et antall skruer 15. I sammenskrudd posisjon, som vist i figuren, dannes en skråttstilt spalte 16 mellom de to delene, slik at det under støpeoperasjonen strømmer vann fra kanalen 14 og gjennom spalten 16 langs hele periferien av det støpte produkt, like utenfor formrommets 17 utløp. Det dannes med dette en primærkjølekrets (primærkjøling av metallet) ved varme som transporteres via veggen (13,14) i formrommet til vannet i kanalen 14 og en sekundærkjølekrets ved vannet som strømmer direkte mot metallet gjennom spalten 16.

Som nevnt er det anordnet permeable ringer 12,13 som er fysisk adskilt fra hverandre ved hjelp av en pakning, tetningsstoff 18 e.l. Disse ringene danner veggen i formrommet 17.

Et viktig trekk ved oppfinnelsen består i at ringformete spalter 20 (se Fig. 2, b)) som dannes mellom støpeformhuset 8 og ringene 12,13 er forsynt med plugger 21 e.l. (bare 2 vist på tegningen) slik at ringrommet 20 er brutt opp i sektor, to eller flere etter ønske/behov. Herved kan tilførselen av både gass og olje differensieres langs omkretsen av formrommet. Slik differensiering, spesielt av gasstilførselen, er viktig for å kunne oppnå et godt støperesultat.

Tilførsel av gass i horisontale, kontinuerlige støpeformer har ikke tidligere vært mulig. For å unngå innslutning av overskuddsgass under støpingen, er det hensiktsmessig anordnet en boring 29 for drenering av gassen ut av formrommet øvre del. Boringen strekker seg igjennom ringen 12 til et ringrom utenfor denne, idet gassen ledes ut av støpeformhuset via en ytterligere boring i dette (ikke nærmere vist).

Ved formrommets 17 innløp er det anordnet en plate 19 av varmeisolerende materiale ("hot-top") som fastholdes ved hjelp av en holdering 22 via en skrueforbindelse 23.

Idet formrommets 17 vegg, dvs. ringene 12,13, danner primærkjøleområdet under støpeoperasjonen, vil arealet av veggflaten representere en av faktorene som bestemmer kjølingen av metallet.

Den isolerende platen 19 kan, avhengig av legeringstype og ønsket primærkjøling, ved et fremspring strekke seg noe innover (ved 24) ringen 12.

Idet platen er enkelt løstagbar, vil det være lett å skifte plate og derved støpe forskjellig typer legeringer i samme støpeform.

Støpeutstyret i h.h.t. oppfinnelsen virker ellers på følgende måte:
Flytende metall, f.eks. aluminium, fylles i kulpen 2 fra en støpeovn e.l. (ikke vist), Metallet strømmer gjennom åpningen 4 og hullene 25,26 i platen 19 til formrommet 17.

Ved begynnelsen av støpeoperasjonen er utløpet 27 i støpeformen 3 lukket ved hjelp av en bevegbar støpesko (ikke vist). Så snart metallet har fylt formrommet 17, begynner skoen å forskyve seg, samtidig som vann tilføres gjennom spalten 16 og gass og olje tilføres gjennom ringen 12,13.

Etter hvert som støpeskoen forskyver seg og metall etterfylles i formrommet via kulpen, dannes et langstrakt støpeemne. Skoen tas bort så snart støpeemnet har nådd en viss lengde. Siden støpeprosessen er kontinuerlig, kan emnet i og for seg anta hvilken som helst lengde, men hensiktsmessig kuttes emnet (ikke vist) i passende lengder for ekstrudering eller andre formål.

Som nevnt ovenfor, så er støpeutstyret innrettet for differensiert tilførsel av olje og gass rundt omkretsen.

Spesielt når det gjelder tilførselen av gass, er det funnet hensiktsmessig å tilføre samme mengde gass rundt hele omkretsen av formrommet ved oppstart av støpeprosessen. Deretter, når støpeprosessen har kommet i gang og stabilisert seg, reduseres eller utelates gasstilførselen til formrommets øvre område.

For øvrig når det gjelder primærkjølingen, dvs. kjølingen gjennom ringene 12,13 i formrommet 17, er det, for å redusere kjølingen, funnet hensiktsmessig å fremstille formhuset 8 av stål, istedenfor aluminium som er vanlig. Videre for ytterligere å redusere kjølingen kan det være aktuelt å skjerme (redusere varmeoverføringen) mot kjølekanalen 14 ved å anordne en isolerende ringplate 28, f.eks. av plexiglass, på den siden av husdelen som vender mot kjølekanalen. Denne kan hensiktsmessig være utskiftbar og ha forskjellig tykkelse.

Oppfinnelsen slik den er definert i kravene er ellers ikke begrenset til de utførelser som er vist i tegningene og beskrevet i det foranstående. Således kan det i stedet for to separate ringer (12,13) være anordnet bare én ring med tilførsel av gass og/eller olje i en og samme ring.

Patentkrav

1. Anordning ved utstyr for kontinuerlig, horisontal støping av metall, spesielt aluminium, innbefattende et isolert reservoar eller kulp (2) som er innrettet til å romme flytende metall, samt en i forhold til kulpen (2), løstagbart anordnet støpeform (3) med en isolerende plate (19) med hull (25,26) som kommuniserer med støpeformen, hvilken støpeform (3) innbefatter et fortrinnsvis sirkulært formrom (17) med en vegg (12,13) av permeabelt materiale for tilførsel av olje og/eller gass, hvilken vegg er innrettet for primærkjøling av metallet som støpes, samt minst en langs omkretsen av formrommet anordnet ringdyse (16) for direkte tilførsel av kjølemedie ved sekundærkjøling av metallet,
k a r a k t e r i s e r t v e d at primærkjølingen er innrettet slik at den kan reduseres eller økes.

2. Anordning ifølge krav 1,
k a r a k t e r i s e r t v e d at den isolerende platen (19) er lett utskiftbar, idet den er forsynt med et fremspring (24) som strekker seg inn over veggen (12,13) i formrommet (17), hvorved veggflaten og derved kjøleflaten kan økes eller reduseres avhengig av fremspringets (24) lengde.

3. Utstyr ifølge kravene 1 og 2,
k a r a k t e r i s e r t v e d at formhuset (8) er fremstilt av stål.

4. Utstyr ifølge kravene 1-3,
k a r a k t e r i s e r t v e d at støpeformhuset består av to deler (8,9) med en mellomliggende kjølekanal (14) , idet det mot den ene første delen (8) som omslutter det permeable materialet (12,13) i formrommet (17) er anordnet en varmeisolerende ringplate (28) for å redusere varmeovergangen til formrommet.

5. Anordning ifølge krav 4,

k a r a k t e r i s e r t v e d at den isolerende platen (28) er utskiftbar og kan ha forskjellig tykkelse.

Sammendrag

Anordning ved utstyr for kontinuerlig, horisontal støping av metall, spesielt aluminium. Utstyret innbefatter et isolert reservoar eller kulp (2) som er innrettet til å romme flytende metall, samt en i forhold til kulpen (2), løstagbart anordnet støpeform (3) med en isolerende plate (19) med hull (25,26) som kommuniserer med støpeformen. Støpeformen (3) innbefatter på sin side et fortrinnsvis sirkulært formrom (17) med en vegg (12,13) av permeabelt materiale for tilførsel av olje og/eller gass, hvilken vegg er innrettet for primærkjøling av metallet som støpes. Langs omkretsen av formrommet er det anordnet ringdyse (16) for direkte tilførsel av kjølemedie ved sekundærkjøling av metallet. Primærkjølingen er innrettet slik at den kan reduseres eller økes. Ved en foretrukket utførelse er den isolerende platen (19) lett utskiftbar, idet den er forsynt med et fremspring (24) som strekker seg inn over veggen (12,13) i formrommet (17), hvorved veggflaten og derved kjøleflaten kan økes eller reduseres avhengig av fremspringets (24) lengde.